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(54) Method and apparatus for printing multicolored container body blanks in a single pass

Verfahren und Vorrichtung zum Bedrucken vonmehrfarbigen Zuschnitten für Behältermäntel in einem einzigen Durchgang

Méthode et appareil pour imprimer en une seule passe les flans multicolorés d'un corps de récipient

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(73) Proprietor:
Crown Cork & Seal Company, Inc.
Philadelphia, Pa. 19136 (US)

(72) Inventors:
- **Howard, William R.**
  Holland, Pennsylvania 18966 (US)
- **Tysver, Oliver J.**
  Flossmoor, Illinois 60422 (US)
- **Osheff, Sheldon**
  Northbrook, Illinois 60062 (US)
- **McGrail, John G.**
  River Forest, Illinois 60305 (US)
- **Petrie, Robert J.**
  Oak Lawn, Illinois 60453 (US)

(74) Representative:
Hepp, Dieter et al
Hepp, Wenger & Ryffel AG,
Friedtalweg 5
9500 Wil (CH)

(56) References cited:
WO-A-90/02045
GB-A- 2 111 912
US-A- 2 369 404
US-A- 3 960 073
US-A- 4 843 962

- **PAPIER + KUNSTSTOFF VERARBEITER INTERNATIONAL no. 2, December 1987, FRANKFURT DE pages 28, 30 - 33 G. A. H. KUPFER "Flexo Printing with Future"**

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Description

Field of the Invention

The current invention is directed to an apparatus for printing multi-colored decorated containers, such as aerosol cans and the like. More specifically, the current invention is directed to a high speed printing press capable of printing individual can body blanks in a variety of colors in a single pass through the press.

Background of the Invention

Traditionally, metal containers destined for the retail market have been either "two piece" or "three piece" types. Two piece cans, which are typically aluminum, have traditionally been used as beverage containers in which strength requirements are low. Such cans are formed by joining a drawn and ironed cylindrical body to a circular lid. Two piece cans are decorated individually in their cylindrical configuration using lithographic printing presses such as that disclosed in U.S. Patents 3,223,028 (Brigham), 3,227,070 (Brigham et al.), 3,766,851 (Sirvet et al.) and 4,138,941 (McMillin et al.). In such presses, a number of inking units are arranged around a central blanket cylinder. Each inking unit transfers the portion of the image to be printed in a single color to the blanket cylinder that then transfers the entire image to the can surface in a single pass. After printing, the cans are cured by baking in an oven. In order to prevent the colors from running together on the blanket, each color must be separated from the adjacent color by a small blank space, referred to as a "trap line."

U.S. Patent 3,960,073 (Rush) discloses decorating two piece cans in a plurality of colors by mounting the cylindrical can bodies on rotating mandrels that protrude from an indexing table. The can bodies are held on the mandrels by vacuum. The indexing table rotates intermittently to carry the can bodies sequentially past printing stations, each of which applies a different color ink, and ultra-violet drying stations. A drying station follows each printing station so that each color ink is cured directly after it is applied. The indexing table dwells at each printing and drying station while the mandrel rotates the can body to facilitate printing and drying.

Three piece cans have been used for many types of food stuffs and also for aerosol containers in which strength is an important requirement. Three piece cans are generally made of steel and are formed by attaching a circular top and a circular bottom to a cylindrical body portion. The body portion is formed by bending a flat rectangular plate, referred to as a body blank, into a cylinder and welding the overlapping longitudinal edges of the body blank to form a joint. The decorations for a three piece can is printed on multi-body blank sheets while still in a flat configuration.

Heretofore, it had been thought that body blanks for three piece cans could only be efficiently printed in a high speed production line by printing a substantial number of the container images in a rectangular array on a large flat metal sheet. After printing, the large sheet was cut into individual body blanks, with each body blank being used to form one can body. It was thought to be economically infeasible to separately print each can body individually in a high speed production environment.

In the traditional three piece can printing approach, the large flat sheet was printed by passing it through a two color lithographic printing press. The press employed two printing plate cylinders, each of which contained the portion of the image to be printed in a single color ink. The inks from both printing plate cylinders were applied to a common blanket cylinder that then applied the two color images to the sheet in a single pass. A number of the images to be printed were arranged side by side on the printing plates so that a row of container images was printed by each rotation of the blanket cylinder. The partially printed sheet was then baked in an oven to cure the inks.

After printing in the first two colors, the printing plates were changed to those containing the portions of the images to be printed in two different colors and the press was supplied with the new color inks. The sheet was then fed through the press in a second pass and rebaked in the oven to cure the newly applied ink. This process was repeated until all the required colors were applied to the sheet. The end result was a large sheet containing a number of can decorations in a rectangular array of rows and columns. After printing, the sheet was cut longitudinally and transversely using a slitter so as to form individual body blanks that were then formed into cylindrical container bodies. Since the inks were cured between each pass it was not necessary to form the aesthetically unappealing trap lines, required in the aforementioned two piece can printing process, to prevent the inks from running together.

Unfortunately, the traditional approach to body blank printing suffers from a variety of drawbacks. First, it is difficult to maintain uniform pressure of the blanket cylinder across such a wide sheet. As a result, the images on the body blanks cut from the center portion of the sheet are often lighter than those cut from the edge portions, causing a lack of uniformity in product appearance when the cans are displayed on a supermarket shelf.

Second, since many cans require printing in eight colors, four separate passes through the press are required. This results in considerable downtime to change the printing plates and clean up the previously used inks.

Third, since the registration of the sheet with the printing plates must be reset for each pass, the image printed in each pass may not be in precise registration with the previously printed images. This problem creates significant inefficiencies when the out-of-registration condition is discovered after the third or fourth pass

since the entire sheet must then be scrapped and the process begun again from scratch.

Accordingly, it would be desirable to provide an efficient high speed method of printing body blanks in which all of the colors were applied in a single pass so that the body blanks are registered to the printing press only once. Such a method should allow for the printing of individual body blanks so that (i) uniform pressure of the blanket cylinder against the body blanks can be maintained, (ii) printing problems can be rapidly detected before unnecessary additional printing was performed, and (iii) if misprinting occurs, only the improperly printed body blanks need be scrapped.

It is known to print paper sheets in a four color printing press utilizing a central rotating impression cylinder about which a number of inking units, each containing a different color ink, are disposed -- see, U.S. Patent No. 4,936,211 (Pensavecchia). Such presses utilize a cam operated clamp to grip the sheets of paper to the impression cylinder which carries the sheet sequentially under each of the inking units. As in the case of the aforementioned press for printing body blanks, it had been though most efficient for such paper presses to print a number of document pages onto a large sheet of paper that is subsequently cut into individual pages. Hence, such paper presses do not solve the problem discussed above of a lack of uniformity in printing across the width of a wide sheet. However, such presses allow multiple colors to be printed in a single pass around the impression cylinder without the need to repeatedly re-register the sheet.

Unfortunately, paper sheet printing presses are not suitable for printing metal plates, such as container body blanks, for several reasons. First, there is no provision in such presses for curing each layer of ink before the sheet passes under the next inking unit. This presents no problem in printing paper sheets since no curing is required to prevent smearing. However, ink applied to a metal substrate must be cured prior to passing it under the next inking unit to prevent smearing and mixing of the inks. It had always been thought that this problem precluded the use of such rotary presses in a high speed metal printing operation because it is infeasible to pass the metal through a curing oven between each inking unit.

A second problem arises with respect to clamping metal body blanks to the impression cylinder. Due to their extreme flexibility, the paper sheets can be readily made to lie flat against the impression cylinder. Consequently, such presses utilize a single clamp to secure each paper sheet to the impression cylinder. Metal body blanks, however, are stiffer and can not be stably secured to the impression cylinder as readily.

Third, such presses utilize rollers to drive the paper sheets around curved guide rollers to bring the sheets into engagement with the clamps. Unfortunately, metal plates are too stiff to be directed to the impression cylinder in this manner.

Fourth, it would be difficult to incorporate more that four inking units into such presses so that the number of colors that can be applied in a single pass is limited.

Accordingly, it would be desirable to provide an efficient high speed press for separately printing individual body blanks in which all of the colors were applied in a single pass of an impression cylinder and that over came the problems of paper presses by (i) developing a method for curing the ink as the body blanks passed between inking units, (ii) developing a method of securely clamping the body blank to the impression cylinder, and (iii) developing a method of properly directing the body blanks to the impression cylinder so that they can be registered and securely clamped into position for all overlapping decorations, thereby allowing ink depositions to be accurately placed.

Summary of Invention

It is an object of the current invention to provide an apparatus and method for printing multicolored container body blanks for containers, especially for three piece containers, in a single pass.

It is another object of the invention that the apparatus and method be capable of printing separate body blanks for containers, especially for three piece containers, individually in a high speed operation.

These and other objects are accomplished in a method having the features of claim 1.

The current invention also comprises an apparatus for printing an image on plates adapted to be formed into containers having the features of claim 6.

Brief Description of the Drawings

Figure 1 is an isometric view of the body blank of a three piece can after it has been printed upon and formed into a cylinder according to the prior art.

Figure 2 is a plan view, partially schematic, of the production line for cutting and printing individual can body blanks according to the current invention.

Figure 3 is an elevation view of the printing press shown in Figure 2.

Figure 4 is an isometric view, partially schematic, of a portion of the printing press shown in Figure 3, including the body blank infeed and discharge conveyors.

Figure 5 is a detailed view of the portion of Figure 3 enclosed by the rectangle marked V, showing an inking unit.

Figure 6 is a cross-section of the printing press shown in Figure 3 in the area where the rim of the impression cylinder meets the inking unit blanket cylinder.

Figure 7 is a detailed view of the portion of Figure 6 enclosed by the circle marked VII, showing the registration pins of the printing plate on the printing plate cylinder.

Figure 8 is an isometric view of an ultraviolet lamp

unit.

Figure 9 is an isometric view from below of the impression cylinder shown in Figure 4 with only one of the clamps shown.

Figure 10 is an isometric view of the body blank infeed conveyor, as well as a portion of the impression cylinder, shown in Figure 3.

Figure 11 is a longitudinal cross-section through the infeed conveyor and the body blank clamp assembly shown in Figure 10.

Description of the Preferred Embodiment

Referring to the drawings, wherein like numerals indicate like elements, there is shown in Figure 1 a body portion 1 of a three piece can according to the prior art. As previously discussed, the body portion is made by forming a flat printed body blank 32 into a cylindrical configuration and welding the cylinder closed along the overlapping joint 2.

Figure 2 shows an overall layout of a production line according to the current invention for making the can body portion 1. A sheet 4 of a magnetic metal, such as steel, approximately 0.25 mm (0.010 inch) thick, is fed into a conventional scroll shear slitter 3. As is conventional, the sheet 4 is coated with a white base coat on its outer surface and lacquered on its inner surface prior to being fed to the slitter 3. The slitter 3 has two sets of rotating cutting heads (not shown) that first cut the sheet 4 longitudinally into intermediate strips 6 and then cut the strips transversely into individual unprinted body blanks 9 -- that is, into rectangular plates having a width W, corresponding to the can height, and a length L, corresponding to the can diameter. The size of the body blanks will depend on the application. Generally, the body blanks will be no more than approximately 25 cm (10 inches) wide by 25 cm (10 inches) long. Each body blank, after processing, forms a single can body 1 shown in Figure 1.

The unprinted body blanks 9 from the slitter 3 are transported via a body blank transport unit 8, having a robot translator, that places the body blanks 9 alternately into two input hoppers 12. As is conventional, body blanks 9 are extracted from the bottom of the input hopper 12 by vacuum and deposited onto a dual lane input conveyor 15 and transported to a printing press 13, shown in Figure 3. According to the current invention, the body blanks 9 are extracted from the input hopper 12 in pairs so that, as shown best in Figure 4, two parallel streams of body blanks are transported by the input conveyor 15 to an impression cylinder 14 of the printing press 13, discussed further below. As shown in Figure 2, the transport unit 8 rotates the body blanks 90° so that the edge that will ultimately form the lap joint 2, shown in Figure 1, forms the leading edge 64 of each body blank as it is directed to the impression cylinder 14 and clamped thereon. After being carried by the impression cylinder 14 in a circular path encompassing approximately 270°, the printed body blanks 32 are unclamped and guide stripped from the impression cylinder onto a dual lane vacuum conveyor 24.

Returning to Figure 2, the printed body blanks 32 are transported from the vacuum conveyor 24 to a dual lane conveyor 16 that is oriented 90° to the discharge conveyor 24 and that transports them to a varnishing unit 17 in which, as is conventional, a top coat of varnish is applied. After the varnish has been applied and immediately thereafter cured by ultraviolet lamps (not shown in Figure 2), the printed body blanks 32 are transported via a conveyor 19 to a body blank stacking and transfer unit 10 that places stacks of body blanks onto a pallet 11. A take-away system 26 transports the pallets 11 to a can body maker (not shown) that forms the printed body blanks 32 into can bodies 1, shown in Figure 1.

The printing press 13 according to the current invention is shown in Figure 3. A central impression cylinder 14 is mounted for rotation in a support frame 20 and is driven by a motor and gearing (not shown). A number of inking units 18 are supported on the frame 20 and arranged around the periphery of impression cylinder 14. One of the inking units 18 is shown in detail in Figure 5. As is conventional, the inking unit is comprised of an ink fountain 33, an inker roll 60, a doctor roll 61, ink distribution rolls 34, oscillating rolls 62 and form rolls 63, by means of which ink from the fountain is transferred to a printing plate cylinder 35. According to an important aspect of the current invention, photosensitive ink is used in the inking units 18 so that curing can be accomplished by ultraviolet radiation. Such inks may be obtained from INX, Inc. of Elk Grove Village, Illinois.

As shown in Figure 6, the printing plate cylinder 35 contains two identical conventional dry offset lithographic printing plates 54. Alternatively, water litho, letter press, gravure or flexographic printing plates can also be used. Advantageously, the plate cylinder 35 is magnetic so that the printing plates 54 are held in place by magnetic attraction, thereby simplifying plate changeover. As shown in Figure 7, a series of pins 56 project outward from the surface of the plate cylinder 35 and are adapted to mate with close fitting holes 55 in the printing plates 54, thereby ensuring the proper registration of the plates with the cylinder. Each pair of printing plates 54 carries an image that consists of the portion of the label that is to be printed in a single color. Since, according to the current invention, the body blanks 9 are carried by the impression cylinder 14 in two parallel streams, as previously discussed, each printing plate 54 contains two identical images side by side.

As shown in Figure 5, according to the current invention, each inking unit 18 has its own blanket cylinder 36. As is conventional, each blanket cylinder 36 has mounted thereon a compliant blanket 53 adapted to transfer the ink from the printing plates 54 to the body blank 9, as shown in Figure 6. Both the plate cylinder 35 and the blanket cylinder 36 are driven by a gear train

coupled to the impression cylinder 14 gearing so that the surface speed of all three cylinders is the same, thereby ensuring proper rolling contact among the cylinders.

During operation of the press 13, it sometimes occurs that a body blank 9 is not extracted from the input hopper 12 despite efforts of the feed mechanism to the contrary. As a result, there is a gap in the stream of body blanks fed to the impression cylinder 14 that, were corrective action not taken, would result in the blanket cylinder 36 transferring ink directly to the surface of the impression cylinder. This situation is avoided by use of a conventional throw-off mechanism that allows the blanket cylinder 36 to be momentarily retracted from contact with the impression cylinder. Specifically, as shown in Figure 5, the plate cylinder 35 and blanket cylinder 36 are supported on the frame 20 using eccentric mounts 37. Lugs 43 are attached to the eccentric mounts 37. The lugs 43 are coupled by a linkage 38 and a lever 39 to the piston 41 of a pneumatic cylinder 40 mounted on the support frame by means of a bracket 42. When a sensor (not shown) detects the absence of a body blank 9 from the input conveyor 15, it generates a signal that, at the proper time, actuates the pneumatic cylinder 40 causing the plate and blanket cylinders 35 and 36 to pivot on their eccentric mounts 37 so that the blanket cylinder is momentarily retracted from contact with the impression cylinder.

As shown in Figure 3, in the preferred embodiment, eight inking units 18 are utilized so that eight different colors can be applied in a single pass through the printing press 13. However, the number of inking units 18 can be increased or decreased depending on the number of colors to be printed.

An ultraviolet lamp 21 is mounted on the support frame 20 adjacent -- that is, immediately downstream -- of each inking unit 18. Each ultraviolet lamp 21, shown in Figure 8, has an arc activated tubular lamp bulb oriented transversely to the direction of travel of the body blanks 9. The lamp bulb is enclosed by a parabolic reflector 75 adapted to focus the ultraviolet radiation 76 onto the printed body blank 32 so as to rapidly cure the ink by photopolymerization. A shutter 72 is slidably mounted under the reflector 75. The shutter 72, actuated by a Bimba air cylinder 73 supplied with pressurized air 74, prevents ultraviolet radiation from reaching the impression cylinder when the press has temporarily stopped. Cooling water is supplied to the shutter 72 and lamp housing via inlet ports 77 19. Similarly situated outlet ports (not shown) on the opposite side of the lamp 21 discharge the water. In the preferred embodiment, the lamp 21 is approximately 51 cm (20 inches) long and has an output of approximately 157 watts per cm (400 watts per inch). The inventors have determined that such a lamp can adequately cure ink at body blank speeds of up to 122 meters per minute (400 feet per minute). Although Figure 3 shows all of the ultraviolet lamps 21 mounted around the impression cylinder 14, the lamp for the last inking unit 18 could also be mounted over the output conveyor 24, rather than around the impression cylinder.

As shown in Figure 4, the impression cylinder 14 has a number of body blank support segments 28 equally spaced around its circumference and separated by slots 27. In the preferred embodiment, each segment 28 has sufficient length and width to carry two body blanks 9 side by side. Although the impression cylinder 14 could be made narrower or wider to accommodate a lesser or greater number of body blanks 9, it is thought that two body blanks are optimum since increasing the width of the impression cylinder 14 and the blanket cylinders 36 may lead to non-uniformity in the image produced among cans, such as plagued the approach heretofore known in the art, as previously discussed.

As shown in Figure 9, each impression cylinder slot 27 contains a conventional cam operated clamp assembly. The clamp assembly is comprised of two clamps 47 (for the sake of clarity, only one clamp is shown in Figure 9) fixedly mounted side by side on a shaft 31 supported by sleeve bearings 46. Each clamp 47 has a jaw 48 that, when the clamp is closed, is adapted to secure the leading edge 64 of a body blank 9 against the circumference of the impression cylinder 14, as shown in Figure 6. The clamps 47 are biased into their closed positions by a spring 49. As shown in Figure 9, the end of the shaft 31 is coupled to a cam follower 29 by a lever 30. Radially outward displacement of the cam follower 29 causes rotation of the shaft 31 and clamp 47 that overcomes the spring 49 and opens the jaw 48 of the clamp.

As shown in Figure 4, stationary cams 23 are mounted on the support frame 20, adjacent the impression cylinder 14, at the 3 and 6 o'clock locations. As shown in Figure 9, the cam follower 29 travels over the cam surface 44 when the slot 27 reaches the cam locations. A rise 45 in the cam surface 44 radially displaces the cam follower 29 outward so that the jaws 48 of the clamps 47 are opened at the 3 and 6 o'clock locations, thereby facilitating the receiving and releasing of the body blanks 9 from the feed and output conveyors 15 and 24, respectively, as discussed further below. Once the slot 27 has rotated past the 3 and 6 o'clock locations, the cam followers travels past the trailing edge of the cam surface 44 and the clamp jaws 48 automatically close again under the urging of the spring 49.

As previously discussed, due to their stiffness, the metal body blanks 9 can not be securely held on the impression cylinder 14 solely by means of a clamp 47 at each of their leading edges 64. Consequently, according to the current invention, a number of tubular magnets 50 are disposed just below the surface of the impression cylinder circumference downstream of each slot 27. The magnets 50 are adapted to secure the trailing edge 65 of the body blanks 9 to the impression cylinder by magnetic force, as shown in Figure 6.

According to the current invention, two conventional

feed conveyors may be adapted to transport the unprinted body blanks 9 from the input hopper 12 to the impression cylinder 14, one conveyor being used for each of the two parallel streams of body blanks 9 shown in Figure 4. One such conveyor 15 is shown in Figures 10 and 11. The conveyor 15 comprises slide surfaces 51 along which the body blanks 9 slide in a path that is tangent to the circumference of the impression cylinder 14. After being extracted from the input hopper 12, the body blanks 9 are initially driven by dogs 59 that bear against the trailing edges 65 of the body blanks, as shown in Figure 10. The dogs are driven by a chain conveyor 52 so that the speed of the body blanks move faster than the surface speed of the impression cylinder circumference. The dogs 59 are pivotally mounted and ride on a support rail 57 that maintains them in the raised position shown at the right in Figure 10. After driving the body blank into proximity with the impression cylinder 14, the dogs 59 slide off the end of the rails 57 causing them to rotate downward so as to retract from engagement with the body blanks.

As the dogs 59 are retracting, a reciprocating registration slide 66 moves into position behind the body blank 9. As shown best in Figure 11, a pawl 58 on the slide 66 engages the body blank trailing edge 65 and places it under the clamp jaw 48 that has been momentarily opened by the cam 23 at the 6 o'clock location, as previously discussed. The pawl 58 decelerates the body blank 9 so that its speed becomes the same as that of the impression cylinder surface speed and the clamp. When the jaw 48 closes it engages the leading edge of the body blank and further rotation of the impression cylinder 14 pulls the body blank 9 around with the cylinder and brings the magnets 50 progressively closer to the body blank. When the gap between the magnets 50 and the body blank 9 is sufficiently reduced, the precise amount depending on the strength of the magnetic attraction and the weight of the body blank, the rear portion of the body blank is pulled up off of the slide surface 51 and becomes attached to the circumference of the impression cylinder 14, as shown in Figure 6.

Continued rotation of the impression cylinder 14 carries the pair of body blanks 9 sequentially under each of the inking units 18 and ultraviolet lamps 21. Consequently, the blanket cylinder 36 of each inking unit 18 transfers an image forming the portion of the can label in a particular color ink to the body blanks, with the ink images in each color being substantially juxtaposed on images in the other colors to produce a multi-colored label. After application, each color ink image is immediately at least partially cured by exposure to ultraviolet radiation from the adjacent ultraviolet lamp 21 adjacent the inking unit 18. It is important that this curing be accomplished before the body blank 9 passes under the next inking unit 18 to ensure that there is no smearing of the image or transfer of ink between the inking units 18.

By the time the body blanks reach the 3 o'clock location, they have been carried under each inking unit 18 and ultraviolet lamp 21. At this point, the second cam 23 causes the clamps 47 to momentarily open again, thereby allowing a wedge shaped device 25 to strip the printed body blanks 32 from the impression cylinder 14 and deposit them onto a conventional vacuum conveyor 24, as shown in Figure 4. The conveyor 24 directs the printed body blanks for further processing, as previously discussed.

In order to produce body blanks in an economical manner, the line speed should be at least 122 meters per minute (400 feet per minute). In the preferred embodiment, the impression cylinder is approximately 1.5 m (5 feet) in diameter and rotates at approximately 25 RPM so that the linear speed of the body blanks 9 is approximately 122 meters per minute (400 feet per minute) per lane. As previously discussed, the ultraviolet lamps 21 are capable of curing the ink at body blanks speeds as high as 122 meters per minute (400 feet per minute).

The aforementioned line speed of 122 meters per minute (400 feet per minute) and the printing of the body blanks in two parallel streams allows approximately 800 body blanks per minute throughput to be printed by each dual lane press 13. Thus, according to the current invention, the heretofore accepted inability to print body blanks on an individual basis in a high speed operation has been overcome.

The uniformity of printing among body blanks produced by the apparatus according to the current invention is high since the short span of the printing plate and blanket cylinders 35 and 36 ensures uniform contact pressure between the cylinders and between the plate cylinder and the body blanks. In addition, since each body blank is registered to the impression cylinder only once, the accuracy of the relationship between superimposed images of different colors is limited only by the accuracy with which the registration of the various components of the press can be set up and maintained. Consequently, printing problems due to the buildup of registration tolerances after repeated registrations are eliminated. Moreover, if printing problems do occur, they can be quickly detected since only finished body blanks exit the press. Thus, the press can be immediately stopped and only the small number of body blanks already improperly printed need be scrapped. This is in contrast to the conventional approach in which an entire sheet of body blanks must be scrapped when, after several passes through the press, a misprint is detected.

Claims

1. Method of forming metal body blanks or plates (32) printed in a plurality of colors and suitable for being formed into container bodies or containers (1), comprising the steps of:

    a) cutting a sheet (4) of said metal into a plurality of said body blanks (9);

b) transporting said body blanks to an impression cylinder (14) and sequentially securing each of said body blanks thereon;

c) applying a first color ink onto said body blanks by rotating said impression cylinder so as to carry said secured body blanks sequentially past a first inking unit (18);

d) at least partially curing said first color ink applied by said first inking unit by rotating said impression cylinder so as to carry said secured body blanks sequentially past a first curing device (21);

e) applying at least a second color ink onto said body blanks by rotating said impression cylinder so as to carry said secured body blanks sequentially from said first curing device to at least a second inking unit (18);

f) at least partially curing said second color ink applied by said second inking unit by rotating said impression cylinder so as to carry said secured body blanks sequentially past at least a second curing device (21); and

g) sequentially releasing said body blanks from said impression cylinder (14) and transporting said body blanks therefrom.

2. Method according to claim 1, wherein the step of securing said body blanks (9) to said impression cylinder (14) comprises the step of attracting said body blanks to said impression cylinder by magnetic force.

3. Method according to claim 1 or 2, wherein each of said body blanks is adapted to be formed into only one container body (1).

4. Method according to one of claims 1 to 3, wherein the steps of transporting said body blanks (9) to said impression cylinder (14) and carrying said body blanks therearound comprise the steps of transporting and carrying said body blanks in at least two substantially parallel streams.

5. Method according to one of claims 1 to 4, wherein the step of cutting said sheet (4) of metal into body blanks (9) comprises the step of cutting said sheet into approximately rectangular pieces no more than approximately 25 cm wide by 25 cm long.

6. Apparatus for printing an image on metal body blanks or plates (9) adapted to be formed into container bodies or containers (1), comprising:

a) a rotating impression cylinder (14) adapted to carry each of said plates (9) individually in a substantially circular path;

b) a plurality of stationary inking units (18) disposed around the periphery of said impression cylinder, whereby said impression cylinder carries said plates under each of said inking units, each of said inking units adapted to apply an ink image to said plates; and

c) a plurality of curing devices (21) for curing said ink applied by said inking units disposed around the periphery of said impression cylinder, one of said curing devices disposed adjacent each of said inking units, whereby said impression cylinder carries said plates under each of said curing devices.

7. Apparatus according to claim 6, wherein the rotating impression cylinder (14) having holding devices (47, 50) for simultaneously securing a plurality of plates (9) onto support segments (28) formed on the impression cylinder.

8. Apparatus according to claim 6 or 7, wherein said impression cylinder (14) has both mechanical (47) and magnetic (50) devices for holding each of said plates (9) against the circumference of said impression cylinder.

9. Apparatus according to claim 8, wherein:

a) each of said plates (9) has a leading edge (64) delivered to said impression cylinder (14) by a transporter or conveyor (15);

b) said mechanical holding device (47) comprises a plurality of clamps for clamping said leading edges of said plates to said circumference of said impression cylinder; and

c) said magnetic holding device (50) comprises a magnet disposed below said circumference of said impression cylinder.

10. Apparatus according to one of claims 6 to 9, wherein each of said plates (9) is adapted to be formed into only one of said containers (1).

11. Apparatus according to one of claims 6 to 10, further comprising said conveyor (15) adapted to transport said plates (9) to said impression cylinder (14) in a plurality of parallel streams, and wherein said impression cylinder is adapted to carry one of said plates from each of said streams side by side along said circular path, whereby a plurality of said plates pass simultaneously under each of said inking units (18) and each of said curing devices (21).

12. Apparatus according to one of claims 6 to 11, further comprising a cutter (3) for cutting a flat sheet (4) into a plurality of plates (9).

Patentansprüche

1. Verfahren zum Bilden von metallenen Körper-Roh-

lingen oder Platten (32), die in einer Mehrzahl von Farben bedruckt sind und sich für die Verformung zu Behältermänteln oder Behältern (1) eignen, enthaltend folgende Schritte:

a) Schneiden eines Bleches (4) aus dem Metall in eine Mehrzahl der Körper-Rohlinge (9);
b) Transportieren der Körper-Rohlinge zu einem Druckzylinder (14) und Befestigen jedes der Körper-Rohlinge nacheinander auf dem Druckzylinder;
c) Auftragen einer Druckfarbe in einer ersten Farbe auf die Körper-Rohlinge durch Drehen des Druckzylinders derart, dass er die darauf befestigten Körper-Rohlinge nacheinander an einer ersten Einfärbeeinheit (18) vorbeibewegt;
d) wenigstens teilweises Trocknen der durch die erste Einfärbeeinheit aufgetragenen Druckfarbe der ersten Farbe durch Drehen des Druckzylinders derart, dass er die darauf befestigten Körper-Rohlinge nacheinander an einer ersten Trocknungseinrichtung (21) vorbeibewegt;
e) Auftragen wenigstens einer Druckfarbe in einer zweiten Farbe auf die Körper-Rohlinge durch Drehen des Druckzylinders derart, dass er die darauf befestigten Körper-Rohlinge nacheinander von der ersten Trocknungseinrichtung zu wenigstens einer zweiten Einfärbeeinheit (18) bewegt;
f) wenigstens teilweises Trocknen der durch die zweite Einfärbeeinheit aufgetragenen Druckfarbe der zweiten Farbe durch Drehen des Druckzylinders derart, dass er die darauf befestigten Körper-Rohlinge nacheinander an wenigstens einer zweiten Trocknungseinrichtung (21) vorbeibewegt; und
g) Lösen der Körper-Rohlinge von dem Druckzylinder (14) nacheinander und Wegtransportieren der Körper-Rohlinge.

2. Verfahren nach Anspruch 1, in welchem der Schritt des Befestigens der Körper-Rohlinge (9) auf dem Druckzylinder (14) ein Anziehen der Körper-Rohlinge gegen den Druckzylinder durch Magnetkraft enthält.

3. Verfahren nach Anspruch 1 oder 2, in welchem jeder der Körper-Rohlinge für die Verformung zu nur einem Behältermantel (1) geeignet ist.

4. Verfahren nach einem der Ansprüche 1 bis 3, in welchem die Schritte des Transportierens der Körper-Rohlinge (9) zu dem Druckzylinder (14) und des Tragens der Körper-Rohlinge um den Druckzylinder ein Transportieren und Tragen der Körper-Rohlinge in wenigstens zwei im wesentlichen parallelen Strömen enthalten.

5. Verfahren nach einem der Ansprüche 1 bis 4, in welchem der Schritt des Schneidens des Bleches (4) aus Metall in Körper-Rohlinge (9) ein Schneiden des Bleches in ungefähr rechteckige Stücke von nicht mehr als etwa 25 cm Breite und 25 cm Länge enthält.

6. Vorrichtung zum Drucken eines Bildes auf metallene Körper-Rohlinge oder Platten (9), die sich für die Verformung zu Behältermänteln oder Behältern (1) eignen, enthaltend:

a) einen drehbaren Druckzylinder (14) zum individuellen Tragen jeder der genannten Platten (9) auf einem im wesentlichen kreisförmigen Weg;
b) eine Mehrzahl von stationären Einfärbeeinheiten (18), die um den Umfang des Druckzylinders herum angeordnet sind, wobei der Druckzylinder die genannten Platten unter jede der Einfärbeeinheiten trägt und jede Einfärbeeinheit dazu eingerichtet ist, ein Bild aus Druckfarbe auf die genannten Platten aufzutragen; und
c) eine Mehrzahl von Trocknungseinrichtungen (21) zum Trocknen der durch die Einfärbeeinheiten aufgetragenen Druckfarbe, welche Trocknungseinrichtungen um den Umfang des Druckzylinders herum angeordnet sind, wobei je eine der Trocknungseinrichtungen benachbart zu jeder der Einfärbeeinheiten angeordnet ist und der Druckzylinder die genannten Platten unter jede der Trocknungseinrichtungen trägt.

7. Vorrichtung nach Anspruch 6, in welcher der drehbare Druckzylinder (14) Halteeinrichtungen (47, 50) zum gleichzeitigen Halten einer Mehrzahl von Platten (9) auf Tragsegmenten (28) aufweist, die auf dem Druckzylinder gebildet sind.

8. Vorrichtung nach Anspruch 6 oder 7, in welcher der Druckzylinder (14) sowohl mechanische (47) als auch magnetische (50) Einrichtungen zum Halten jeder der genannten Platten (9) auf dem Umfang des Druckzylinders aufweist.

9. Vorrichtung nach Anspruch 8, in welcher

a) jede der genannten Platten (9) einen vorderen Rand (64) aufweist, der dem Druckzylinder (14) durch eine Transport- oder Fördereinrichtung (15) zugeführt wird;
b) die mechanische Halteeinrichtung (47) eine Mehrzahl von Klemmen zum Festklemmen der vorderen Ränder der Platten auf dem Umfang des Druckzylinders besitzt; und
c) die magnetische Halteeinrichtung (50) einen

unter dem Umfang des Druckzylinders angeordneten Magnet enthält.

10. Vorrichtung nach einem der Ansprüche 6 bis 9, in welcher jede der genannten Platten (9) für die Verformung zu nur einem der Behälter (1) geeignet ist.

11. Vorrichtung nach einem der Ansprüche 6 bis 10, in welcher die Fördereinrichtung (15) dazu eingerichtet ist, die genannten Platten (9) in einer Mehrzahl von parallelen Strömen zu dem Druckzylinder (14) zu transportieren, und in welcher der Druckzylinder dazu eingerichtet ist, je eine der genannten Platten aus jedem der genannten Ströme Seite an Seite durch den kreisförmigen Weg zu tragen, wobei eine Mehrzahl der Platten gleichzeitig unter jeder der Einfärbeeinheiten (18) und jeder der Trocknungseinrichtungen (21) hindurchläuft.

12. Vorrichtung nach einem der Ansprüche 6 bis 11, ferner enthaltend eine Schneideinrichtung (3) zum Zerschneiden eines flachen Bleches (4) in eine Mehrzahl von Platten (9).

Revendications

1. Procédé de formation de flans ou plaques de corps en métal (32) imprimés en plusieurs couleurs et convenant pour être transformés en corps de récipients ou en récipients (1), comportant des étapes consistant à:

   a) découper une feuille (4) dudit métal en plusieurs desdits flans de corps (9);
   b) transporter lesdits flans de corps vers un cylindre d'impression (14) et fixer successivement chacun desdits flans de corps sur ce dernier;
   c) appliquer une première encre de couleur sur lesdits flans de corps en faisant tourner ledit cylindre d'impression de manière à amener successivement lesdits flans de corps fixés devant une première unité d'encrage (18);
   d) durcir au moins partiellement ladite première encre de couleur appliquée par ladite première unité d'encrage en faisant tourner ledit cylindre d'impression de manière à amener successivement lesdits flans de corps fixés devant un premier dispositif de durcissement (21);
   e) appliquer au moins une deuxième encre de couleur sur lesdits flans de corps en faisant tourner ledit cylindre d'impression de manière à amener successivement lesdits flans de corps fixés depuis le premier dispositif de durcissement jusqu'à au moins une deuxième unité d'encrage (18);
   f) durcir au moins partiellement ladite deuxième encre colorée appliquée par ladite deuxième unité d'encrage en faisant tourner ledit cylindre d'impression de manière à amener successivement lesdits flans de corps fixés devant au moins un deuxième dispositif de durcissement (21); et
   g) libérer successivement lesdits flans de corps dudit cylindre d'impression (14) et éloigner lesdits flans de corps de ce dernier.

2. Procédé selon la revendication 1, dans lequel l'étape de fixation desdits flans de corps (9) sur ledit cylindre d'impression (14) comporte l'étape consistant à attirer lesdits flans de corps vers ledit cylindre d'impression par une force magnétique.

3. Procédé selon les revendications 1 ou 2, dans lequel chacun desdits flans de corps est adapté pour être transformé en un seul corps de récipient (1).

4. Procédé selon l'une des revendications 1 à 3, dans lequel les étapes consistant à transporter lesdits flans de corps (9) vers ledit cylindre d'impression (14) et à transporter lesdits flans de corps autour de ce dernier comprennent les étapes consistant à transporter et à déplacer lesdits flans de corps en au moins deux flux essentiellement parallèles.

5. Procédé selon l'une des revendications 1 à 4, dans lequel l'étape consistant à découper ladite feuille (4) en métal en flans de corps (9) comporte l'étape consistant à découper ladite feuille en pièces approximativement rectangulaires ne dépassant pas environ 25 cm de large par 25 cm de long.

6. Appareil pour imprimer une image sur des flans ou plaques de corps en métal (9) adaptés à être transformés en corps de récipients ou en récipients (1), comportant:

   a) un cylindre d'impression rotatif (14) adapté pour transporter individuellement chacune desdites plaques (9) dans un parcours essentiellement circulaire;
   b) plusieurs unités d'encrage stationnaires (18) disposées autour de la périphérie dudit cylindre d'impression, ledit cylindre d'impression transportant lesdites plaques en-dessous de chacune des unités d'encrage, chacune des unités d'encrage étant adaptées pour appliquer une image encrée sur lesdites plaques: et
   c) plusieurs dispositifs de durcissement (21) servant à durcir ladite encre appliquée par lesdites unités d'encrage disposées autour de la périphérie dudit cylindre d'impression, l'un desdits dispositifs de durcissement étant disposé en position adjacente à chacune desdites unités d'encrage, ledit cylindre d'impression trans-

portant lesdites plaques en-dessous de chacun desdits dispositifs de durcissement.

7. Appareil selon la revendication 6, dans lequel le cylindre d'impression rotatif (14) est doté de dispositif de retenue (47, 50) pour fixer simultanément plusieurs plaques (9) sur des segments de support (28) formés sur le cylindre d'impression.

8. Appareil selon les revendications 6 ou 7, dans lequel ledit cylindre d'impression (14) est doté de dispositifs mécaniques (47) et magnétiques (50) pour retenir chacune desdites plaques (9) contre le circonférence dudit cylindre d'impression.

9. Appareil selon la revendication 8, dans lequel:

a) chacune desdites plaques (9) présente un bord de tête (64) apporté audit cylindre d'impression (14) par un transporteur ou convoyeur (15);
b) ledit dispositif mécanique de retenue (47) comporte plusieurs pinces pour pincer lesdits bords de tête desdites plaques sur ladite circonférence dudit cylindre d'impression; et
c) ledit dispositif de retenue magnétique (50) comporte un aimant disposé en-dessous de ladite circonférence dudit cylindre d'impression.

10. Appareil selon l'une des revendications 6 à 9, dans lequel chacune desdites plaques (9) est adaptée pour être transformée en un seul desdits récipients (1).

11. Appareil selon l'une des revendications 6 à 10, comportant en outre ledit convoyeur (15) adapté pour transporter lesdites plaques (9) vers ledit cylindre d'impression (14) en plusieurs flux parallèles, et dans lequel ledit cylindre d'impression est adapté pour porter l'une desdites plaques provenant de chacun desdits flux, côte à côte le long dudit parcours circulaire, plusieurs desdites plaques passant simultanément en-dessous de chacune desdites unité d'encrage (18) et de chacun desdits dispositifs de durcissement (21).

12. Appareil selon l'une des revendications 6 à 11, comportant en outre une découpeuse (3) pour découper une feuille plane (4) en plusieurs plaques (9).

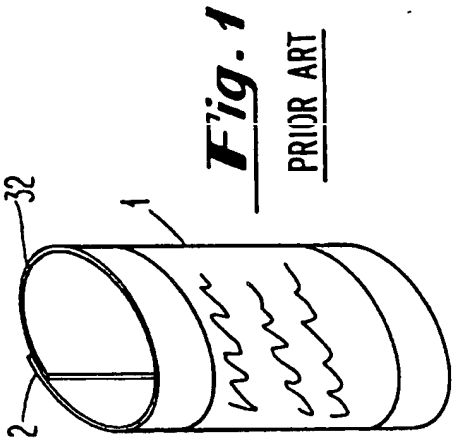


Fig. 1
PRIOR ART

Fig. 2

Fig. 3

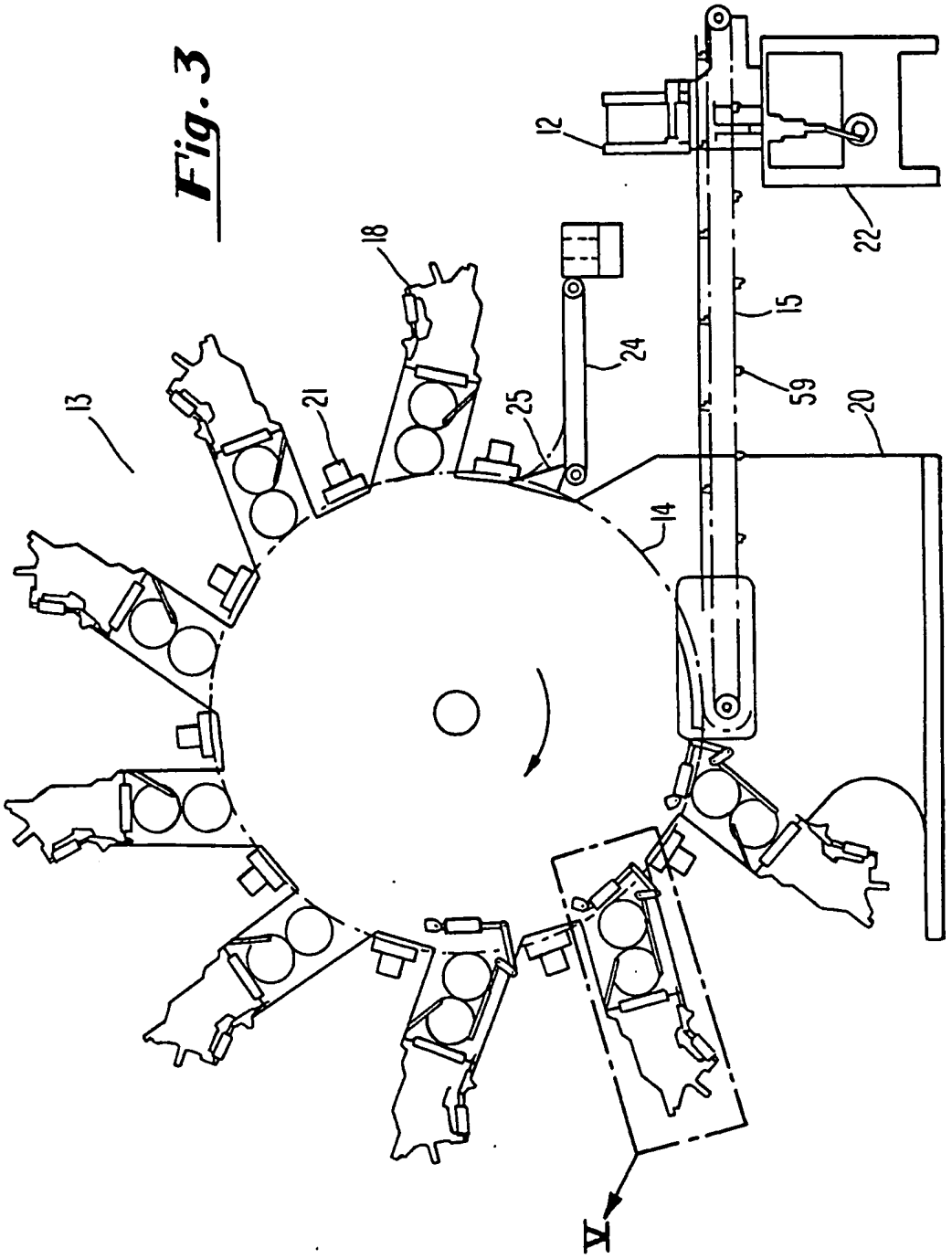
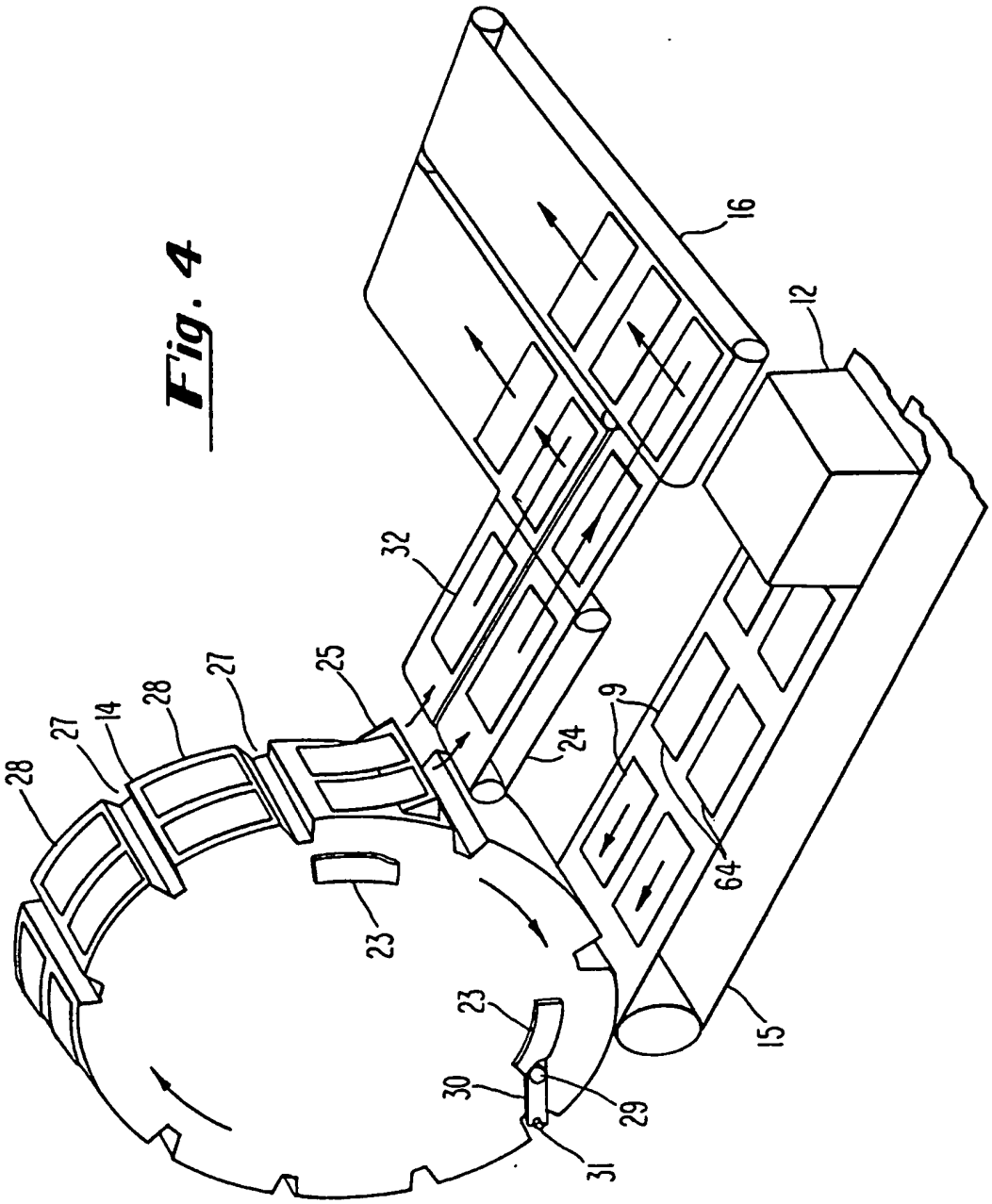


Fig. 4



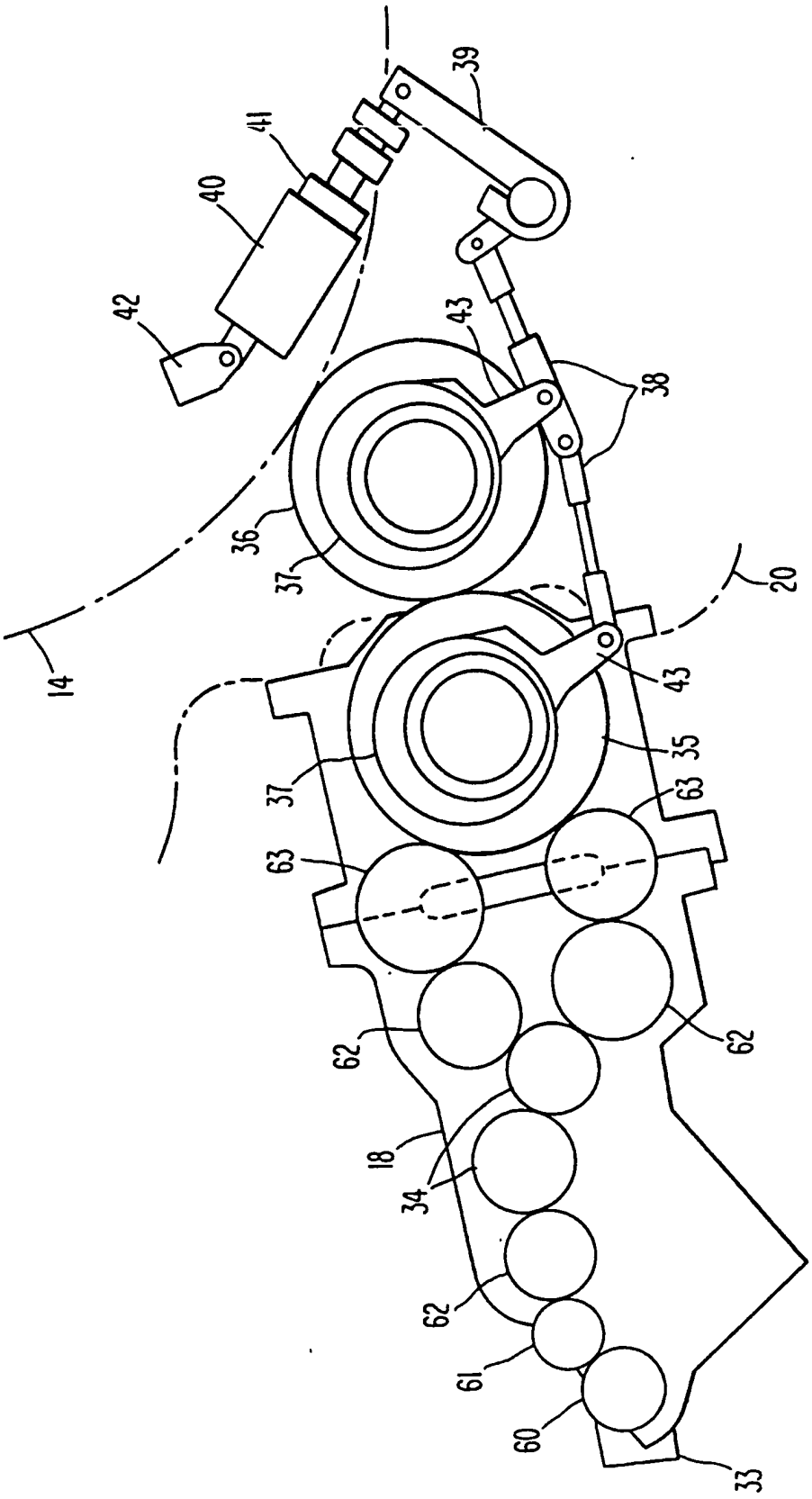


Fig. 5

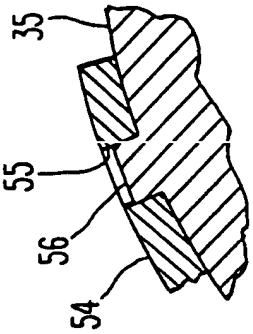


Fig. 7

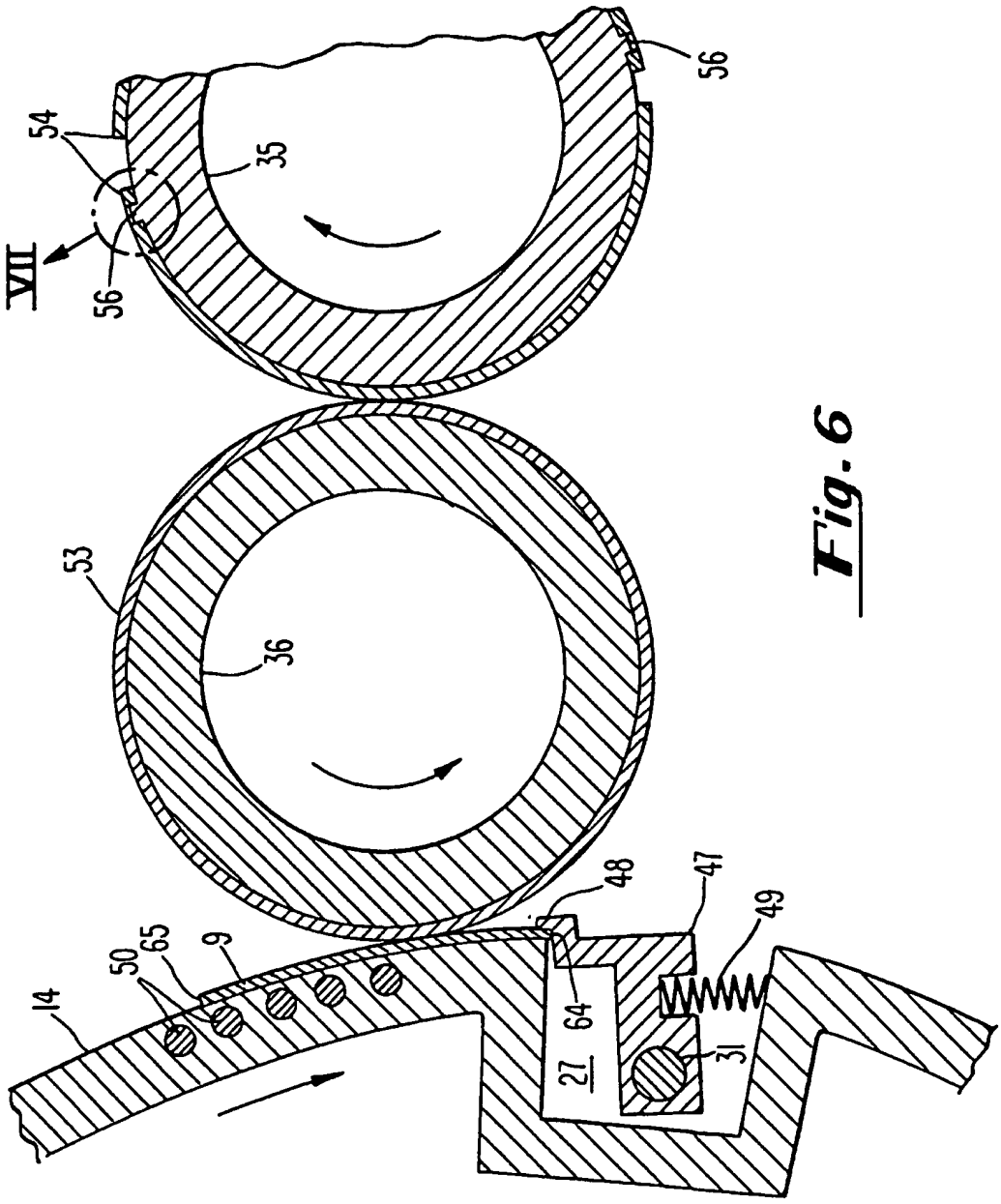


Fig. 6

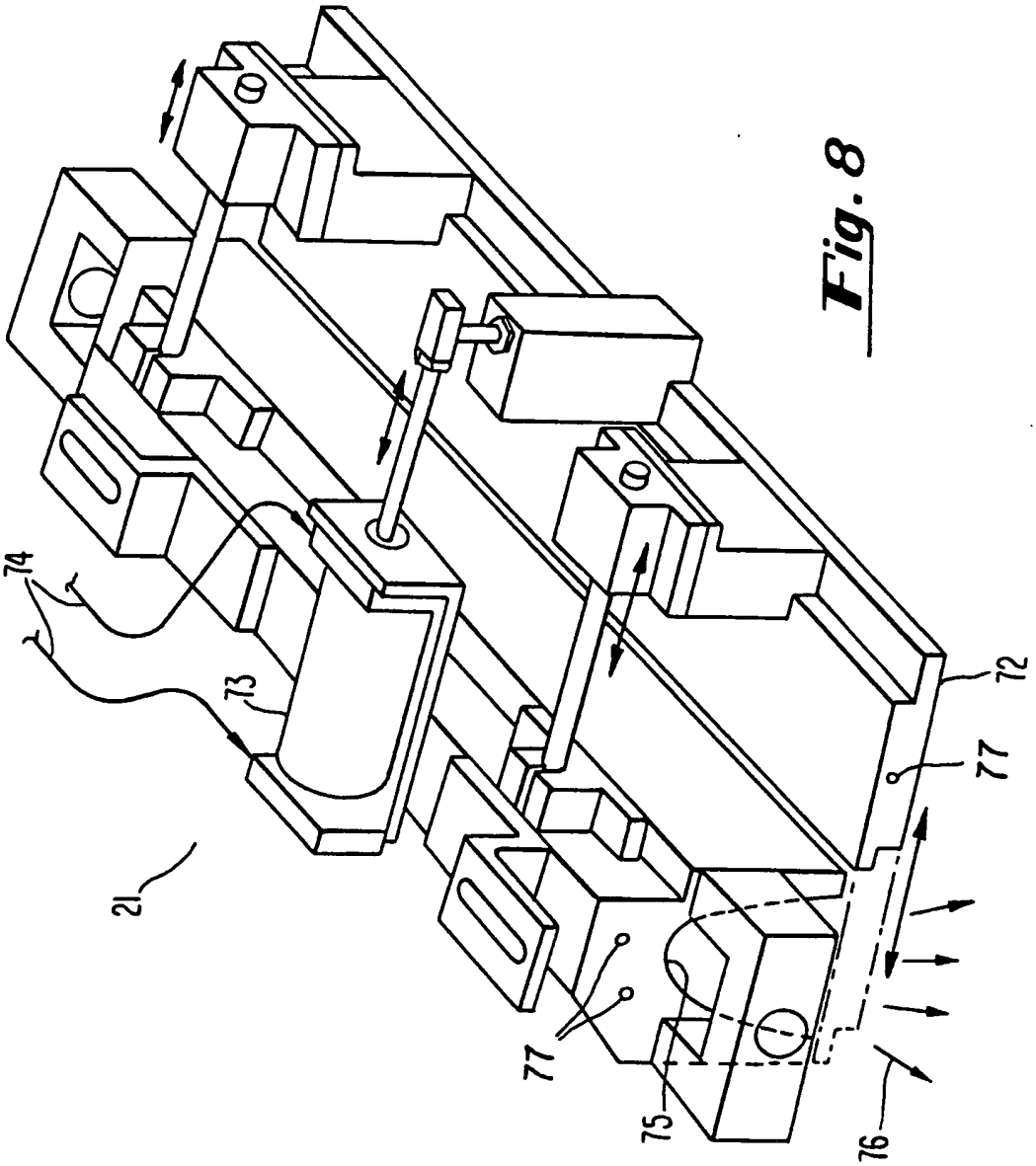


Fig. 8

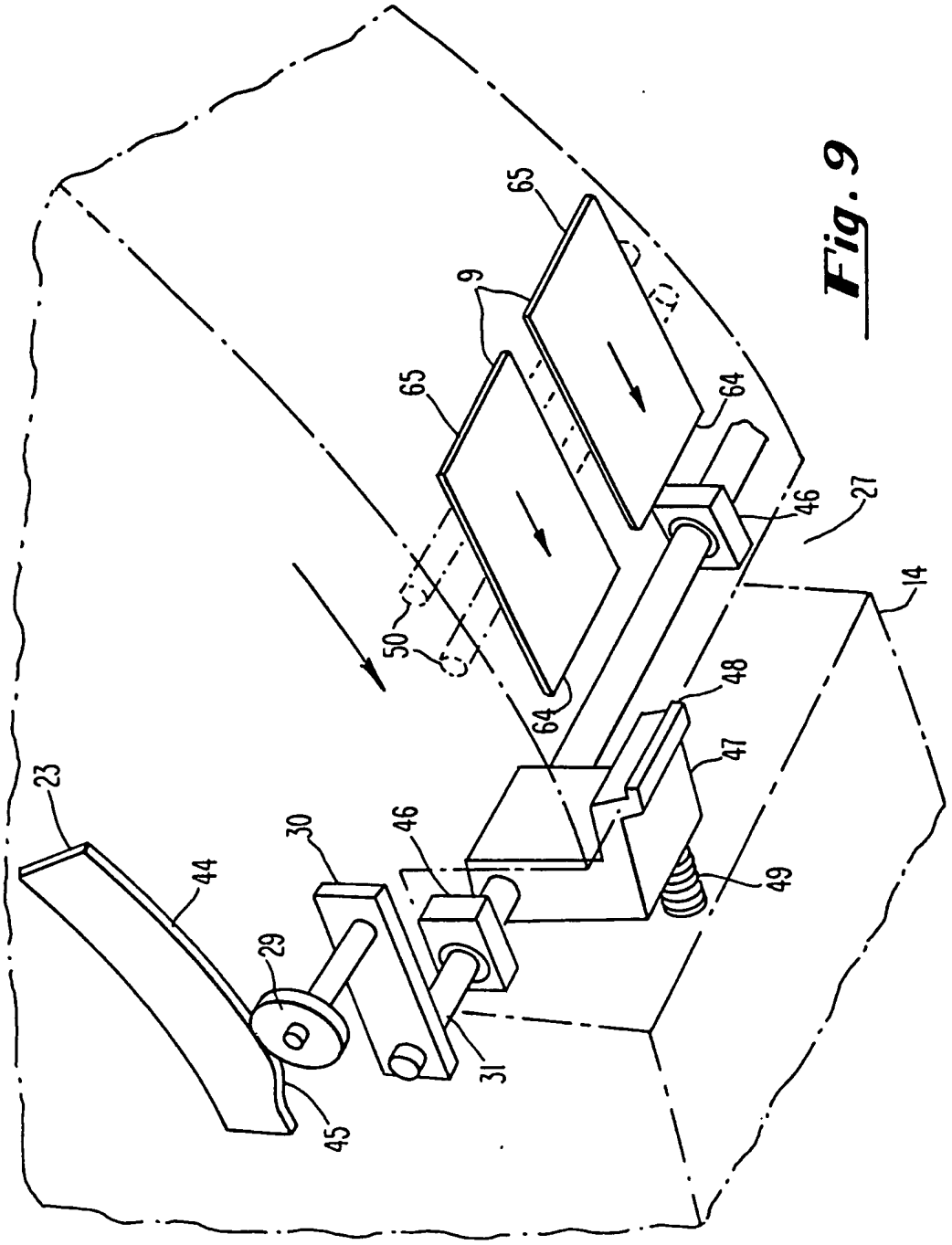


Fig. 9

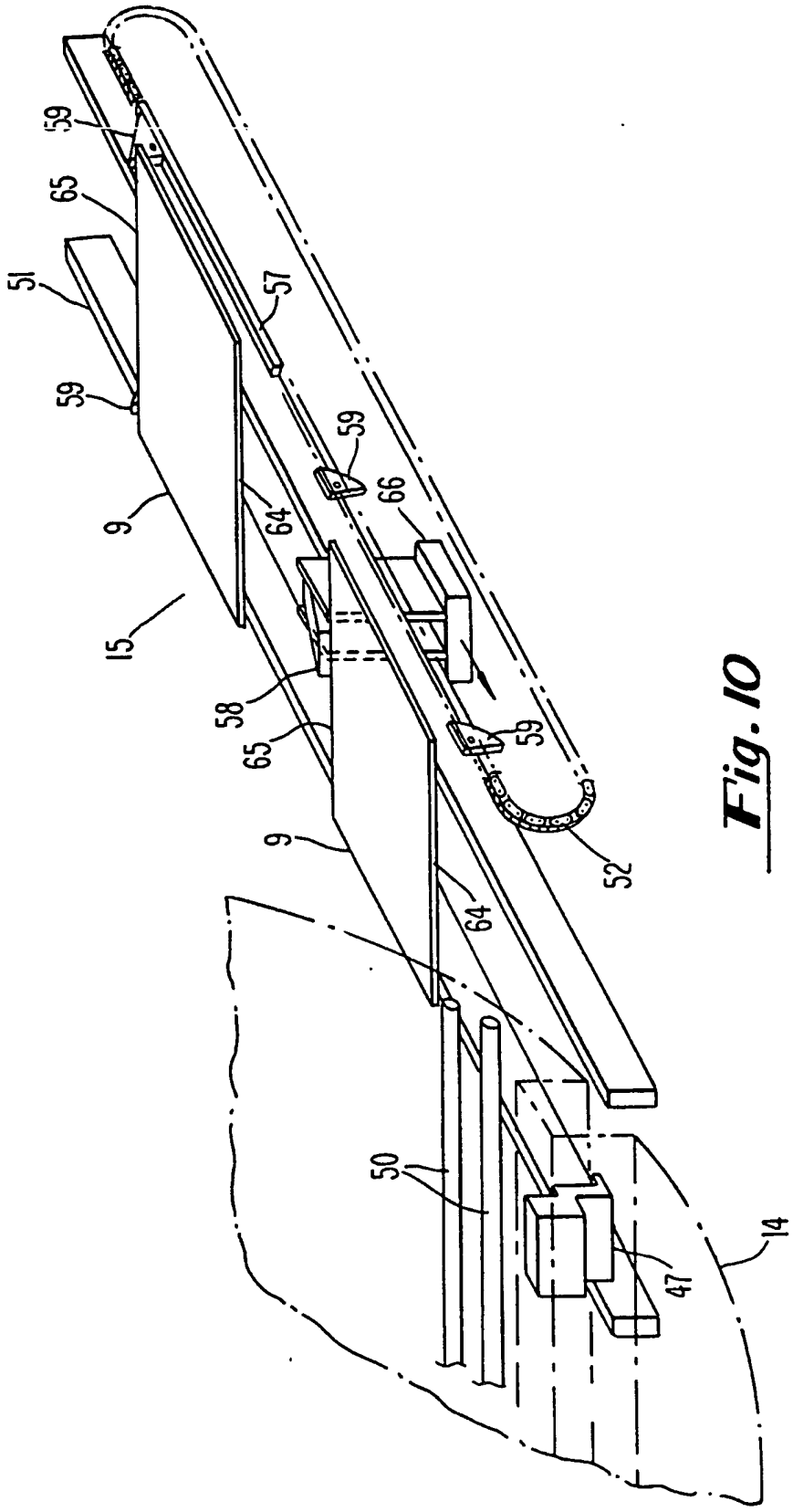


Fig. 10

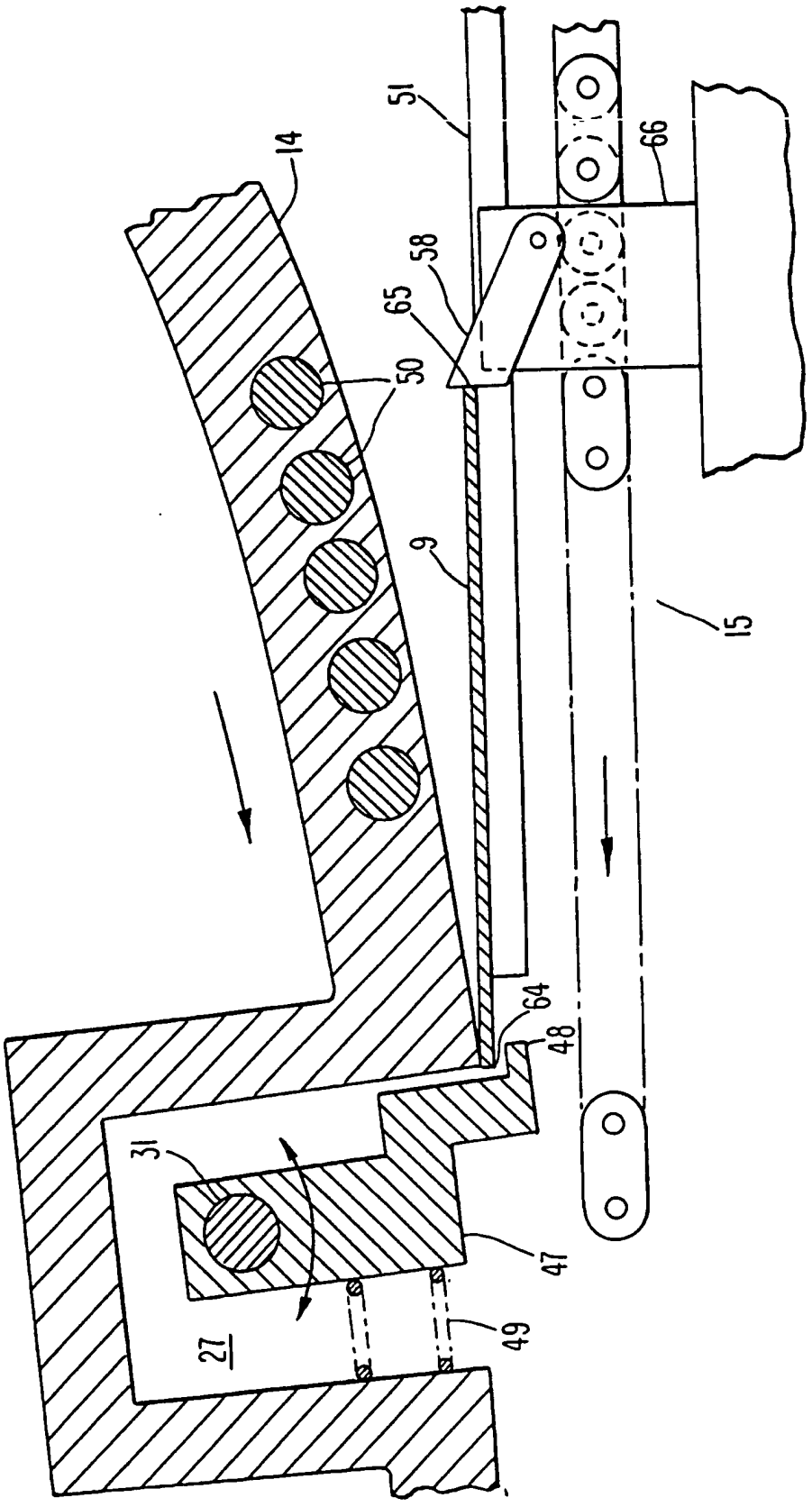


Fig. 11